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TRANSMITTAL OF APPEAL BRIEF (Large Entity)

Docket No. FIS920030307US1

In Re Application Of: **A. Chakravarti, et al.**

Application No.	Filing Date	Examiner	Customer No.	Group Art Unit	Confirmation No.
10/684,596	October 15, 2003	L. M. Schillinger	30743	2813	1755

Invention: **DEPOSITION OF CARBON AND NITROGEN-DOPED POLY SILICON FILMS, AND RETARDED BORON DIFFUSION AND IMPROVED POLY DEPLETION**

COMMISSIONER FOR PATENTS:

Transmitted herewith in triplicate is the Appeal Brief in this application, with respect to the Notice of Appeal filed on **October 14, 2005**

The fee for filing this Appeal Brief is: **$500.00**

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Mary E. Goulet

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Dated: **December 12, 2005**

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DEC 12 2005
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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

In re patent application of

A. Chakravarti et al.

Group Art Unit 2813

Serial No. 10/684,596

Examiner: Schillinger, Laura M.

Filed: October 15, 2003

For: ***DEPOSITION OF CARBON AND NITROGEN-DOPED POLY SILICON FILMS, AND RETARDED BORON DIFFUSION AND IMPROVED POLY DEPLETION***

MAIL STOP APPEAL BRIEF
Commissioner for Patents
P.O. Box 1450
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APPELLANTS' BRIEF UNDER 37 C.F.R. § 41.37

In response to the action of the Primary Examiner in finally rejecting claims 1, 4-5, 7-8, 10, 13-14, 23-24 of this application, a Notice of Appeal was timely filed October 14, 2005. This brief, which is filed herewith in triplicate, is in furtherance of the Notice of Appeal.

This brief contains these items under the following headings and in the order set forth below, as required under 37 C.F.R. § 41.37:

I. REAL PARTY IN INTEREST

II. RELATED APPEALS AND INTERFERENCES

III. STATUS OF CLAIMS

IV. STATUS OF AMENDMENTS

V. SUMMARY OF CLAIMED SUBJECT MATTER

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VI. GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

VII. ARGUMENTS

☐ ARGUMENT VIIA. REJECTIONS UNDER 35 U.S.C. §112, FIRST PARAGRAPH

☐ ARGUMENT VIIB. REJECTIONS UNDER 35 U.S.C. §112, SECOND PARAGRAPH

☑ ARGUMENT VIIC. REJECTIONS UNDER 35 U.S.C. §102

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I. REAL PARTY IN INTEREST

The real party in interest in the appeal is:

☐ the party named in the caption of this brief.

☑ the following:

International Business Machines Corporation (IBM) and Applied Materials, Inc.

II. RELATED APPEALS AND INTERFERENCES

With respect to other appeals or interferences that will directly affect, or be directly affected by, or have a bearing on the Board's decision in this appeal:

☑ there are no such appeals or interferences.

☐ these are as follows:

III. STATUS OF CLAIMS

The status of the claims in this application is as follows:

A. Total number of claims in Application

The claims in the application are: Claims 1, 4-5, 7-8,

totaling 5 claims

B. Status of all the claims:

1. Claims cancelled: 2-3, 6, 9-25[1]
2. Claims withdrawn from consideration but not cancelled: None
3. Claims pending: Claims 1, 4-5, 7-8
4. Claims allowed: None
5. Claims rejected: Claims 1, 4-5, 7-8[2]
6. Claims objected to: None

C. Claims on Appeal.

The claims on appeal are: Claims 1, 4-5, 7-8

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[1]Claims 17-20 were canceled as directed to the non-elected invention of Group II as set forth in the restriction requirement dated December 17, 2004.

[2]The Advisory Action dated October 12, 2005 states that Claims 1, 4, 5, 7, 8, 10, 13, 14, 23-24 are rejected, however, claims 9-25 were cancelled in the 116 Amendment dated September 7, 2005.

IV. STATUS OF AMENDMENTS

The status of amendments filed subsequent to the final rejection is as follows: There is an after-final amendment canceling Claims 9-25. The Examiner in the Advisory Action shows Claims 23-24 as rejected and Claims 21 and 25 as withdrawn from consideration. Clarification of the cancelled status of Claims 9-25 is respectfully sought.

V. SUMMARY OF THE CLAIMED SUBJECT MATTER

The claimed invention, defined in independent claim 1, and in dependent claims 4-5 and 7-8, is directed to processes for growing amorphous or polycrystalline silicon.

In one embodiment, the invention may be expressed as a process for growing amorphous or polycrystalline silicon, comprising growing a film, including mixing:

(A) SiH_4 (silane)[3] or a silane derivative selected from the group consisting of disilane, trisilane, hexachloro disilane and dichloro silane, with

(B) bis-tertiary butyl amino silane (BTBAS) (Figure 3),

with a growth time in a range of 15 to 600 seconds for a Rapid Thermal Chemical Vapor Deposition (RTCVD) or Plasma Enhanced Chemical Vapor Deposition (PECVD) process, at a pressure in a range of sub-millitorr to atmosphere, at a temperature in a range of 300 to 800 degrees C. (Appealed Claim 1.) Amorphous silicon (*see* Appealed Claim 1) or polycrystalline silicon (*see* Appealed Claims 1, 5) is grown. The produced films are carbon- and nitrogen-rich and have a desired sheet-like nitrogen and carbon profile not achieved using other production methods.[4]

Films made by the present invention have desired characteristics making them suited to certain industrial uses, such as in a commercial product such as CMOS logic.[5] Using the present invention, films may be produced that are superior to films produced according to the conventional method in which nitrogen content is increased in a gate oxide by post-oxidation plasma doping such as RPN or DPN, which conventional method creates an undesirable long N-tail into the channel resulting in PFET VT instability/ increase and mobility degradation.[6]

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[3]*See* Appealed Claim 4.

[4]Applicants' specification, page 10, lines 20+.

[5]Applicants' specification, page 10, lines 11-13.

[6]Applicants' specification, page 10, lines 14-20.

There also is noted the process embodiment wherein a polysilicon film is produced by a process including mixing: silane, in a range of 1 to 99% with BTBAS, in a range of 1 to 99%. (*See* Appealed Claim 7.) Especially noted is such a process including mixing silane at 45 sccm with BTBAS at 200 sccm. (*See* Appealed Claim 8.)

VI. GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

The issues presented in this Appeal are:

Whether Claims 1, 4-5, 7-8 are anticipated by U.S. Patent No. 6,500,772 to Chakravarti et al. (Chakravarti '772).

ARGUMENT VIIA. REJECTIONS UNDER 35 U.S.C. §112, FIRST PARAGRAPH

There are no rejections under 35 U.S.C. §112, first paragraph.

ARGUMENT VIIB. REJECTIONS UNDER 35 U.S.C. §112, SECOND PARAGRAPH

There are no rejections under 35 U.S.C. §112, second paragraph.

ARGUMENT VIIC. REJECTIONS UNDER 35 U.S.C. §102

Pursuant to an Office Action dated June 14, 2005, (the "Final Rejection"), claims 1, 4-5, 7-8 were erroneously rejected under 35 U.S.C. §102(e) as being anticipated by Chakravarti '772. Applicants respectfully submit that none of claims 1, 4-5, 7-8 is anticipated.

Chakravarti '772 does not disclose a "process for growing amorphous or polycrystalline silicon" as recited in Applicants' claim 1. In Chakravarti '772, there is not a disclosure that "amorphous or polycrystalline silicon is grown" as in Applicants' claim 1. In Chakravarti '772, a method for depositing "a silicon nitride or oxynitride film" is disclosed. (Chakravarti '772, col. 1, lines 48-49; *see also* col. 1, line 66; col. 2, line 2; col. 2, line 10.) A silixon dioxide film is mentioned in Chakravarti '772, col. 2, line 5. Thus, Claims 1, 4-5, 7-8 are all distinguished from Chakravarti '772 in this regard.

Another difference is that Chakravarti '772 does not disclose using BTBAS with silane (SiH_4), disilane, trisilane, hexachloro disilane or dichloro silane in a RTCVD or PECVD process. The parts of Chakravarti '772 that the Examiner cites in the final office action do not identically disclose what is presently claimed:

Col.1, lines 10-16 only disclose silane or dilane (without disclosing additionally to mix BTBAS as recited in Applicants' claim 1) in a CVD process (which is not an RTCVD or a PECVD process as recited in Applicants' claim 1);

Col. 1, lines 17-20 (Background section) disclose making silicon nitride films, not growing amorphous or polycrystalline silicon as recited in Applicants' claim 1.

Col. 1, line 18 (Background section) discloses mixing dichlorosilane with ammonia (not with BTBAS as recited in Applicants' independent claim 1), and what is being made is a silicon nitride film (not amorphous or polycrystalline silicon as recited in Applicants' claim 1);

Col. 1, line 19 (Background section) discloses mixing silane with ammonia (not with BTBAS as recited in Applicants' claim 1), and again, what is being made is a

silicon nitride film (not amorphous or polycrystalline silicon as recited in Applicants' claim 1);

Col. 2, lines 35-40 only disclose BTBAS with other gases NOT with silane, disilane, trisilane, hexachloro disilane or dichloro silane as recited in Applicants' claim 1. As permissible additional components, Chakravarti '772 mentions inert gases (nitrogen, argon, helium); oxidizing gases (oxygen, ozone, nitrous oxide, nitric oxide, nitrogen dioxide, and carbon dioxide); and reducing gases (NH_3)--not silane, disilane, trisilane, hexachloro disilane or dichloro silane as recited in Applicants' claim 1.

Col. 4, lines 50-60 of Chakravarti '772 is in the Example, and does not disclose Applicants' presently claimed invention. In that Example, helium is bubbled through liquid BTBAS and delivered to a silicon substrate. Ammonia and nitrous oxide are also introduced to the chamber. The Chakravarti '772 Example does not disclose using any of the presently claimed ingredient (A) components (silane, disilane, trisilane, hexachloro disilane or dichloro silane) of Applicants' claim 1. Nowhere does Chakravarti '772 teach or disclose to mix silane (or a silane derivative named in Applicants' paragraph (A) of claim 1) with BTBAS. BTBAS is disclosed for use in the '772 invention. However, when silane and disilane are mentioned in the reference, it is not for use in the invention, but only as (non-BTBAS) background processes. The reference does not teach or disclose use of silane or disilane together with BTBAS.

Thus, for the several reasons set forth above, Applicants' independent claim 1 is distinguished from and not anticipated by Chakravarti '772.[7]

As to claim 4, the Examiner has cited Fig. 2 of Chakravarti '772. However, that Fig. 2 does not disclose BTBAS with SiH_4 (silane). Rather, in Chakravarti's '772, BTBAS is used with ammonia. Moreover, in Fig. 2 of the reference, it is carbon-

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[7]Additionally, the difference of Applicants' presently claimed invention from the '772 patent is substantial. In the Background section of the '772 patent, after silane is mentioned as a commonly used precursor in CVD of silicon-based films, the rest of this section (col. 1, lines 20-45, especially lines 37-40) discusses the drawbacks of using silane precursors. Thus, a person of ordinary skill in the art would not reasonably be expected to modify Chakravarti '772 in that direction. The presently claimed invention therefore may be appreciated to be non-obvious over the '772 patent.

enriched silicon nitride film being made, not amorphous or polycrystalline silicon that is being grown.

As to claim 5, which recites that "a polysilicon film is grown," the Examiner has cited col. 2, lines 10-15 of the reference which mentions "silicon oxide" films. "Silicon oxide" (in the reference) is not a synonym for "polysilicon" (recited in appealed claims 1 and 5).

As to claim 7, which recites mixing silane with BTBAS, the Examiner has cited Figs. 1 and 2 of the reference, neither of which figure involves use of silane (which is formula SiH_4).

As to claim 8, which recites mixing silane with BTBAS, the Examiner has cited col. 4, lines 45-60, which fails to disclose to mix BTBAS with silane.

It is therefore respectfully submitted that the anticipation rejection cannot be maintained as to any of claims 1, 4, 5, 7 or 8.

ARGUMENT VIID. REJECTIONS UNDER 35 U.S.C. §103

There is no rejection under 35 U.S.C. §103

ARGUMENT VIIE. REJECTION OTHER THAN 35 U.S.C. §§102, 103 AND 112

There are no rejections other than under 35 U.S.C. §§ 102, 103, and 112.

VIII. CLAIMS APPENDIX

The text of the claims involved in this Appeal are:

1. A process for growing amorphous or polycrystalline silicon, comprising:
growing a film, including mixing:
(A) SiH_4 or a silane derivative selected from the group consisting of disilane, trisilane, hexachloro disilane and dichloro silane, with
(B) bis-tertiary butyl amino silane (BTBAS),
with a growth time in a range of 15 to 600 seconds for a RTCVD or PECVD process, at a pressure in a range of sub-millitorr to atmosphere, at a temperature in a range of 300 C to 800 C;
wherein amorphous or polycrystalline silicon is grown.

4. The process of claim 1, wherein silane is mixed with BTBAS.

5. The process of claim 1, wherein a polysilicon film is grown.

7. The process of claim 5, including mixing:
silane, in a range of 1 to 99% with
BTBAS, in a range of 1 to 99%.

8. The process of claim 7, including mixing silane at 45 sccm with BTBAS at 200 sccm.

IX. EVIDENCE APPENDIX

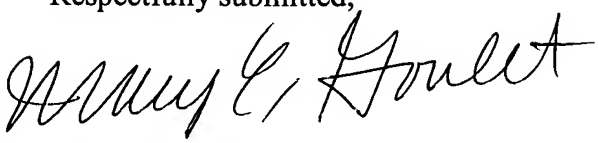
No evidence was submitted in this case under 37 C.F.R. 1.130, 1.131, or 1.132, and no evidence was entered separately by the Examiner.[8]

[8]In the Office Action dated February 17, 2005, the Examiner indicated that the anticipation rejection might be overcome either by a showing under 37 CFR 1.132 that any invention disclosed but not claimed in the reference was derived from the inventor of this application and is thus not the invention "by another," or by an appropriate showing under 37 CFR 1.131. However, it is believed that the presently claimed inventions differ from the reference and that therefore such a declaration is not required.

X. RELATED PROCEEDINGS APPENDIX

No decisions have been rendered in any court or by the Board in a related appeal or interference.

Respectfully submitted,



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